

RESEARCH AND TESTING TO ESTABLISH UPDATED SPECIFICATIONS FOR FAA AIRFIELD QUALITY HOT MIX ASPHALT



**Federal Aviation
Administration**



**Presented to: 2010 FAA Worldwide Airport Technology
Transfer Conference**

By: Navneet Garg, FAA

Date: April 20-22, 2010

HMA DESIGN

- P-401 – based on Marshall Mix Design Procedure.
- Industry following FHWA/SHRP guidelines.
- Engineering Brief #59A - Item P-401 Plant Mix Bituminous Pavements (Superpave).
- May 2006 (original Dec. 2001).



HMA DESIGN USING GYRATORY COMPACTOR

- Part of RPD 136 – Improved Paving Materials
- The main objective is to produce a similar HMA mix using gyratory equipment
 - Appropriate N_{design} values (number of gyrations for design)



HMA DESIGN USING GYRATORY COMPACTOR

- Work is being performed by –
 - SRA International, Inc. (FAA's support contractor)
 - ERDC, Vicksburg, MS (Interagency Agreement)
 - Parallel project under AAPTP program

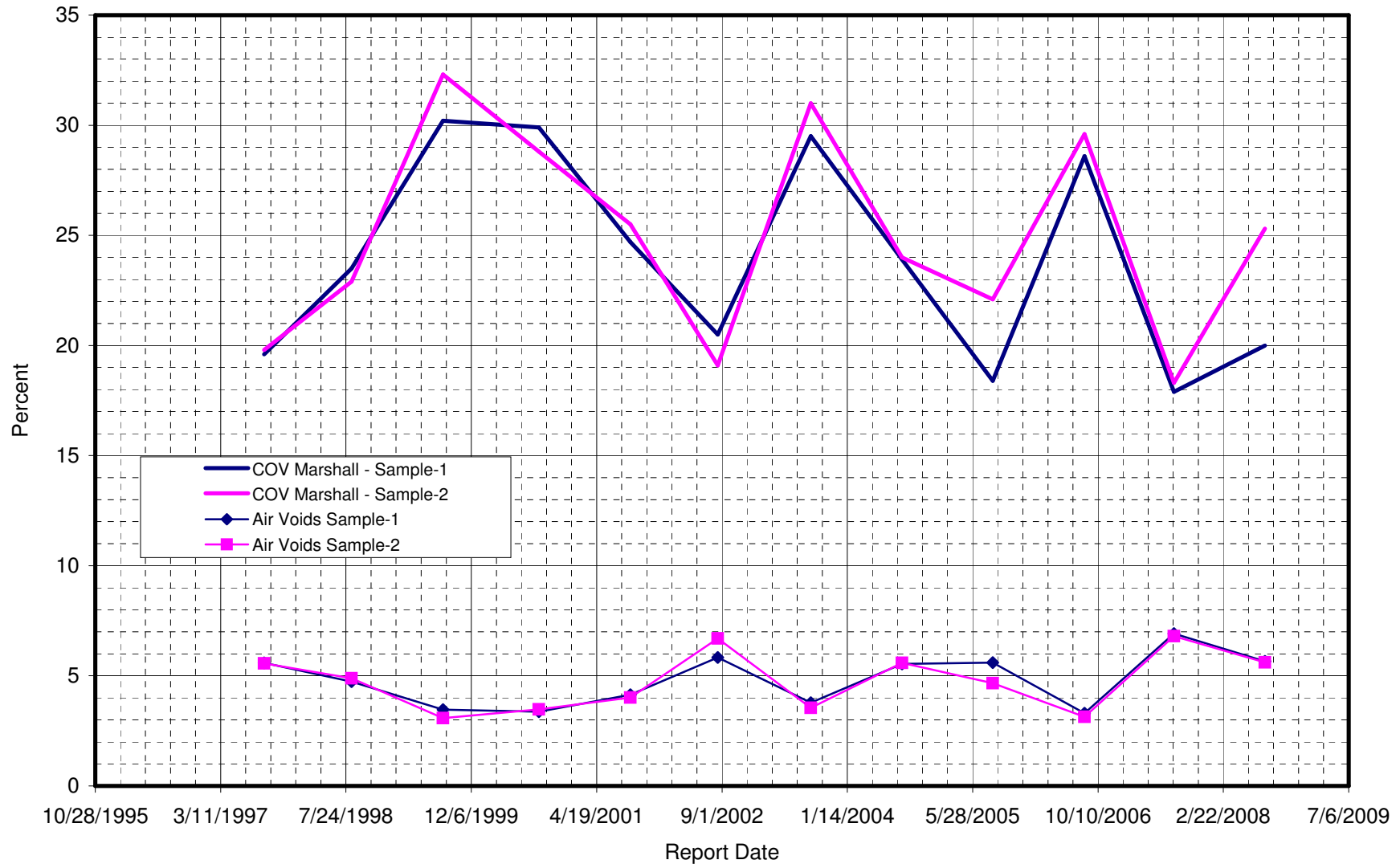


HMA DESIGN

- Traditional P-401 asphalt material has performed satisfactory.
- Material requirements of P-401 similar to SUPERPAVE.



AMRL LAB STUDY
Marshall Mix Design - Air Voids in Bituminous Mix



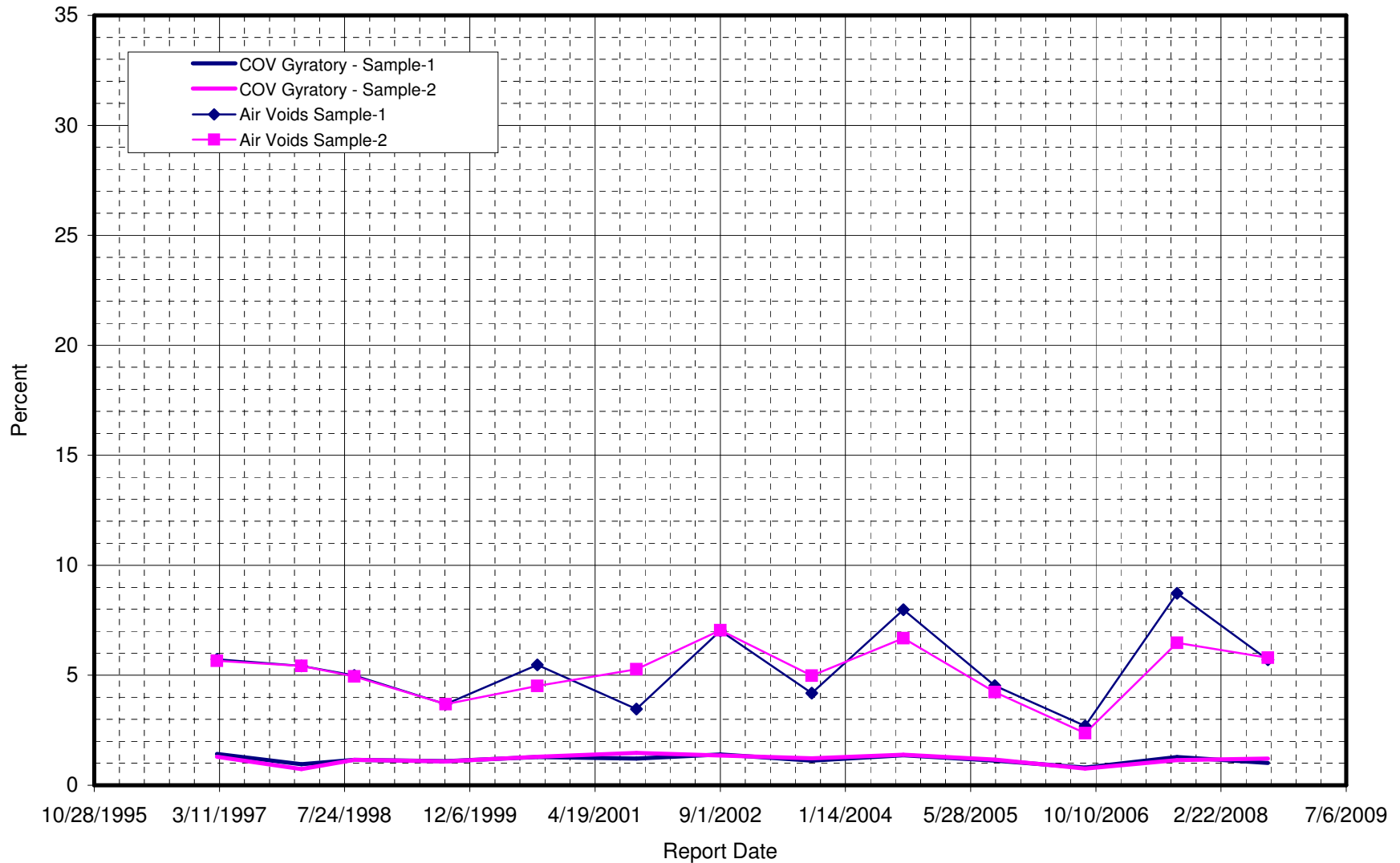
Research and Testing to Establish Updated Specifications for FAA Airfield Quality HMA

April 20-22, 2010



Federal Aviation
Administration

AMRL LAB STUDY
Gyratory Compactor - Air Voids in Bituminous Mix at 100 Gyrations



Research and Testing to Establish Updated Specifications for FAA Airfield Quality HMA

April 20-22, 2010



Federal Aviation
Administration

SUMMARY OF ERDC STUDY

- 28 mixes selected for testing.
- 6 mixes eliminated (could not meet P401 stability test requirements).
- 75-blow Marshall.
- Number of gyration for 3.5% air voids.



SUMMARY OF ERDC STUDY

- Mineralogy: Limestone, Granite, Gravel
- Aggregate Size: 0.5, 0.75, 1 inch Max
- Gradation: Coarse & Fine Sides of P-401 Band
- Binder: PG 64-22 & PG 76-22
- N_{design} Range: 21 to 125



SUMMARY OF ERDC STUDY

- **Significant factors affecting N_{design} :**
 - Sand content
Natural-59 vs Crushed-75
 - Aggregate type
 - Gravel-50, Granite-84, Limestone-69
 - Aggregate gradations

Numbers after aggregate types are gyrations.



SUMMARY OF ERDC STUDY

- Aggregate Size
- Unmodified vs Polymer Modified
did not have any significant effect on N_{design}

Recommendation – 70 gyrations



SUMMARY OF AAPTP STUDY

- AAPTP 04-03 by Burns Cooley Dennis, Inc.
- Both P-401 and UFGS Specifications
- Gradation Issues
- Volumetrics

Objectives:

- Draft Specification
- Not Just N_{design}



SUMMARY OF APTP STUDY

Approach for N_{design} :

- Compare In-place Density to Orig N_{design}
- Compare with Marshall

Mixes:

- Included Southwest, West Coast Mixes
- Not all well-performing
- Several Military mixes
- Also, 50 blow Marshall mix designs.



SUMMARY OF AAPTP STUDY

Performance Test:

- Repeated Load Permanent Deformation Test (Flow Number Test)
- Deviator Stress - 100, 200, 350 psi and 40 psi confining pressure.



SUMMARY OF APTP STUDY

Based upon the obtained materials from the original sources for the ten airfields, including all performance levels and type of facilities with some poor to marginal performance:

- 43 to 55 gyrations provide an equivalent compactive effort to 75 blow mix.
- 32 to 40 gyrations provides an equivalent compactive effort to 50 blow mix.



SUMMARY OF AAPTTP STUDY

Recommended N_{design} Values for Designing Airfield Mixes

<u>Tire Pressure, psi</u>	<u>N_{design}</u>
Less than 100	50
100 to 200	65
More than 200	80



SUMMARY OF SRA STUDY

OBJECTIVES

- Establish guidance for N-design levels for HMA designed following P401.
- Establish specifications for designing HMA using SGC that provides performance equivalent to Marshall mixes.
- Verify on a range of mixes.



SUMMARY OF SRA STUDY

- Phase-I Tests:
 - Identify “well performing” P-401 mixes
 - Verify Marshall mix designs
 - Determine N-design
 - Statistical Analysis
 - Determine final values for N-design
 - AAT and Soiltek



SUMMARY OF SRA STUDY

- **Soiltek**
 - $N_{\text{design}} = 71$ gyrations
 - Average AC = 5.42 %
- **AAT**
 - $N_{\text{design}} = 54$ gyrations
 - Average AC = 5.74 %

***Grand Avg.
62 Gyrations***



SUMMARY OF SRA STUDY

- Statistically significant factors
 - Laboratory (AAT vs. Soiltek)
 - Project/Mix Design
- Binder type was not significant



SUMMARY OF SRA STUDY

- Average: 62
- Minimum: 34
- Maximum: 99
- Standard deviation: 16



SUMMARY

- Results from three studies show similar results.
- Variability of Marshall procedure.
- Value of N_{design} of 70 appears reasonable.
- Phase-II - performance testing (rut resistance, fatigue tests, etc).



Questions?

Research and Testing to Establish Updated Specifications for FAA Airfield Quality HMA

April 20-22, 2010



**Federal Aviation
Administration**